



HEP 2013
Stockholm
18-24 July 2013



Contribution ID: 454

Type: **Talk presentation**

Multi-jet cross section ratios and a determination of the strong coupling constant in ppbar collisions at $\sqrt{s}=1.96$ TeV

Thursday 18 July 2013 09:30 (15 minutes)

We present measurements of three different multi-jet cross section ratios. These include the very first measurements of the new quantities $R_{\Delta R}$ and $R_{\Delta\phi}$, and a measurement of $R_{3/2}$. The variable $R_{\Delta R}$ measures the average number of neighboring jets for jets from an inclusive jet sample. The variable $R_{\Delta\phi}$ measures the fraction of the inclusive dijet events in which the azimuthal separation of the two jets with the highest transverse momenta is less than a specified value of the parameter $\Delta\phi_{\max}$. The quantity $R_{3/2}$ is the ratio of the inclusive 3-jet and 2-jet cross sections. All three measurements use an event sample corresponding to an integrated luminosity of 0.7 fb^{-1} collected with the D0 detector at the Fermilab Tevatron Collider. The results are compared to predictions of perturbative QCD calculations at next-to-leading order in the strong coupling with corrections for non-perturbative effects. In most kinematic regions, the theory predictions describe the data well. The $R_{\Delta R}$ data are used to determine the strong coupling constant over a large range of momentum transfers from 50-400 GeV, testing the predictions of the renormalization group equation for its running in a new range of momentum transfers.

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Session Classification: QCD

Track Classification: QCD